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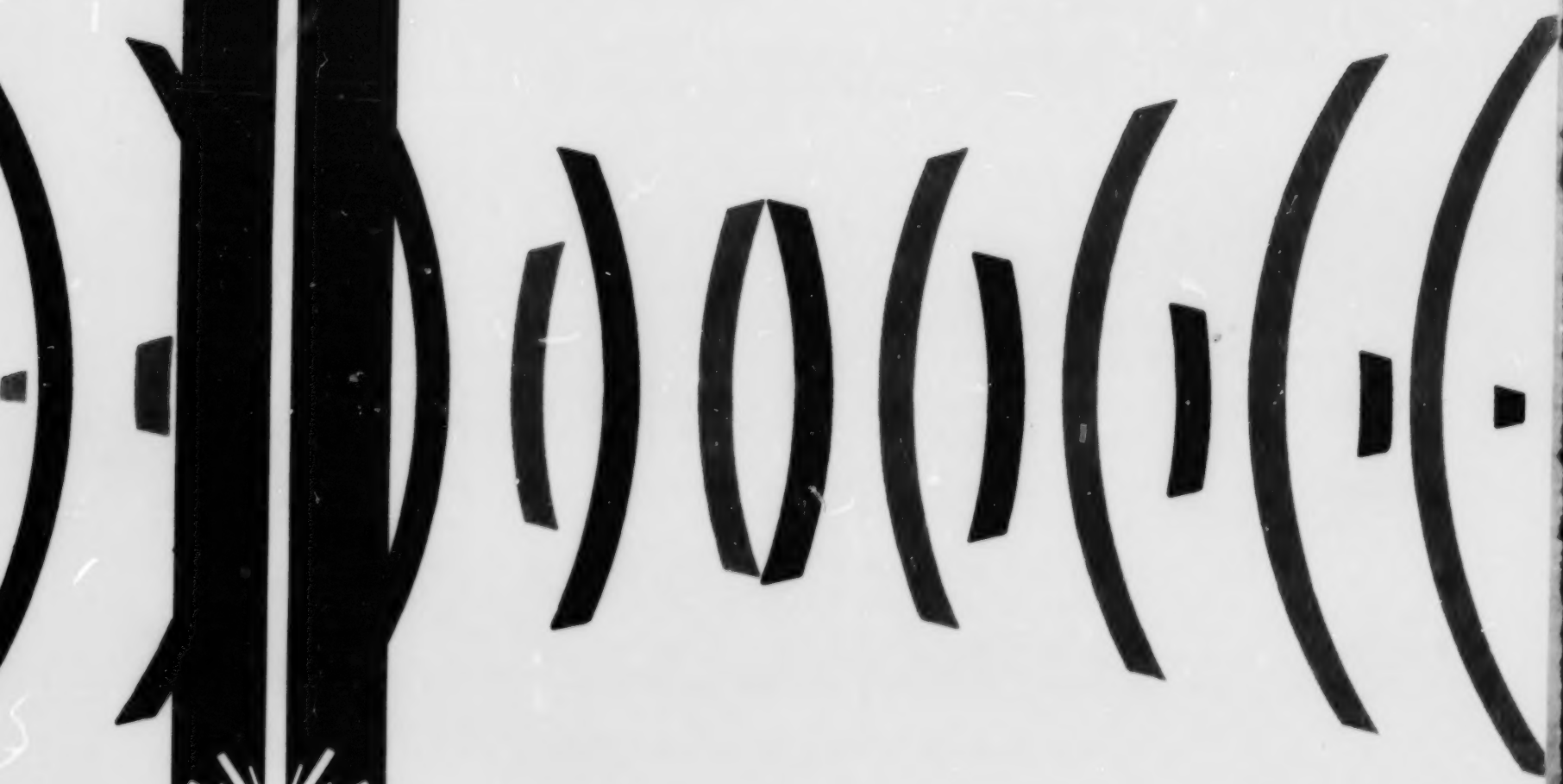
BRH/DEP 70-19

RADIATION SAFETY SURVEYS OF X-RAY FACILITIES WITHIN THE BUREAU OF PRISONS DURING 1968



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service

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(continued on inside of back cover)

BRH/DEP 70-19

RADIATION SAFETY SURVEYS OF X-RAY FACILITIES WITHIN THE BUREAU OF PRISONS DURING 1968

LaVert C. Seabron

Intelligence Branch
Division of Electronic Products

July 1970

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service
Bureau of Radiological Health
Rockville, Maryland 20852

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FOREWORD

The Bureau of Radiological Health, formerly the National Center for Radiological Health, continues to carry out a national program designed to reduce the exposure of man to hazardous ionizing and nonionizing radiation.

Within the Bureau, the Division of Electronic Products (1) develops and administers performance standards for radiation emissions from electronic products, (2) studies and evaluates emissions of and conditions of exposure to electronic product radiation and intense magnetic fields, (3) conducts or supports research, training, development, and inspections to control and minimize such hazards, and (4) tests and evaluates the effectiveness of procedures and techniques for minimizing such exposures.

The Bureau publishes its findings in Radiological Health Data and Reports (a monthly publication), Public Health Service numbered reports, appropriate scientific journals, and technical report series for the Bureau's divisions, offices, and laboratories.

The technical reports of the Division of Electronic Products (DEP) allow comprehensive and rapid publishing of the results of intramural and contractor projects. The reports are distributed to State and local radiological health program personnel, Bureau technical staff, Bureau advisory committee members, university radiation safety officers, libraries and information services, industry, hospitals, laboratories, schools, the press, and other interested individuals. These reports are also included in the collections of the Library of Congress and the Clearinghouse for Federal Scientific and Technical Information.

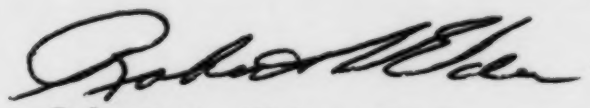
I encourage the readers of these reports to inform the Bureau of any omissions or errors. Your additional comments or requests for further information are also solicited.

John C. Villforth
Director
Bureau of Radiological Health

PREFACE

Since the establishment of the Bureau of Prisons, the Public Health Service of the United States has furnished the Bureau with the necessary medical, dental, psychological, and psychiatric services.

This report describes the first comprehensive survey of the x-ray facilities in the Bureau of Prisons installations throughout the country. It discusses workloads at the facilities, types of equipment, operator training deficiencies, and equipment deficiencies, and presents recommendations for improving radiation protection of operators and patients.



Robert L. Elder, Sc.D.
Director
Division of Electronic Products

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ABSTRACT

This report describes the first comprehensive survey of the x-ray facilities in the Bureau of Prisons installations throughout the United States. The data summarized cover visits to 27 facilities, a total of 60 x-ray machines. The report discusses the workloads at the facilities, the type of equipment, the deficiencies noted in diagnostic radiographic x-ray machines (medical and dental), and operator training. Also included are recommendations for improving both operator and patient protection.

RADIATION SAFETY SURVEYS OF X-RAY FACILITIES WITHIN THE BUREAU OF PRISONS DURING 1968

INTRODUCTION

In the fall of 1967 the Bureau of Prisons' Safety Officer requested a radiation protection survey of the x-ray facilities at the United States Penitentiary at McNeil Island, Washington. This request led to expanded talks between representatives of the then National Center for Radiological Health and the Bureau of Prisons. As a result, the Bureau requested that the Center prepare a proposal which would establish a radiation safety program as part of the Bureau of Prisons' overall safety program.

Subsequent meetings were held with the Bureau's Safety Officer to define the scope and cost of the program, the protocol to be followed in contacting the individual institutions, and the working of a Memorandum of Agreement between the Division of Health Services, Bureau of Prisons, and the Bureau of Radiological Health which would formally provide for the implementation of a facility safety survey program.

The objectives of the facility radiation safety survey program developed for the Bureau of Prisons were:

1. To initiate and conduct a survey of all Bureau of Prisons x-ray installations within a period of one year. Each survey was to include a complete radiological health and safety evaluation as it applied to the safety of patients, operating personnel, and occupants of adjacent areas.

2. To recommend modifications or changes in equipment and/or operating procedures which, when implemented, would reduce patient and occupational exposures.

3. To administer a continuing Bureau-wide registration of radiation sources program to be implemented by the Bureau of Radiological Health.

4. To develop a system whereby all or selected facilities within the Bureau of Prisons would be resurveyed every two years.

5. To promote the application of radiation protection principles among personnel responsible for the operation of x-ray equipment.

By mid-December 1967, all parties concerned had agreed to the terms of the proposal and the Memorandum of Agreement was signed setting the contract initiation date for January 1, 1968, with the installation surveys to begin March 1, 1968 (see appendix A).

PROCEDURE

The procedure followed in carrying out the terms of the Memorandum of Agreement consisted of two phases. These were (1) preliminary scheduling and (2) the actual survey activity.

PRELIMINARY ACTIVITY

Data provided by the Bureau of Prisons indicated that there were an estimated 27 installations in 22 States possessing a total of 55 dental and medical x-ray machines to be surveyed (see figure 1). Based on this information, an estimated project budget was prepared which included personnel costs, travel related expenses, and film badge service at each installation for one year.

Figure 1. Federal Prison System.

To provide for the transfer of funds that would be necessary to finance the survey program, the Bureau of Prisons issued a policy statement to all institutions explaining the purposes of the program, authorizing the transfer of funds, and outlining the procedure to be followed in effecting the transfer (see appendix B).

Also, to ensure that each facility would be surveyed within the time period allotted and at the cost specified in the Memorandum of Agreement, a master facility survey schedule was prepared. The schedule grouped installations by geographic area so that all facilities could be covered in four extended trips. Each trip was designed for a single surveyor, with the projected schedule requiring a total of 42 man-days for completion. Once the master facility survey schedule was approved, the chief medical officer at each facility was contacted by mail to confirm the date(s) for the survey and number of x-ray machines at the facility.

Table 1 provides a comparison between estimated and actual project costs.

Table 1. Project budget data (estimated versus actual).

	Estimated	Actual
Number of facilities	27	26
Number of units	55	60
Medical units	27	35
Dental units	28	25
Man-day required to complete surveys	42	44 1/4
Cost of survey activity	$3,500.00	$3,946.40
Cost of film badge service	$ 500.00	$ 500.00
Total cost of project	$4,000.00	$4,446.40
Cost per facility	$ 148.15	$ 177.85
Cost per unit	$ 72.72	$ 71.71

Additional consultation between Bureau and Center personnel resulted in agreement that the standards as set forth in NCRP Report No. 33, "Medical X-ray and Gamma-Ray Protection for Energies Up to 10 MeV," and National Bureau of Standards Handbook 76, "Medical X-ray Protection Up to Three Million Volts," would be used as guides for the survey and compliance purposes of the project. The data would be collected on forms PHS 4495-1, "X-ray Protection Report--Facility;" PHS 4495-3, "X-ray Protection Survey Report--Radiographic;" PHS 4495-2, "X-ray Protection Report--Fluoroscopic;"

PHS 4495-7, "Radiation Protection Survey Report--Therapeutic;" and X-ray Protection Survey Report--Dental: (a new form which was field tested for the first time in this project). Use of a specially designed registration of radiation sources form was also agreed upon (see appendixes C, D, E, F, and G).

SURVEY ACTIVITY

The survey program officially began on March 5, 1968. Procedures followed by the surveyor were identical for each installation to allow for comparison of data at the conclusion of the survey program.

The equipment used by the surveyor consisted of a Victoreen Condenser-R-Meter including the charger-reader and ionization chambers in the ranges of 0-10 and 0-25 Roentgens full scale, an ionization chamber rate meter, spinning top, fluorescent strips for beam size determinations, steel tape measure, and stopwatch.

At each facility the x-ray machine was registered on the Radiation Source Registration Form (see appendix H), and an equipment identification decal imprinted with a registration number was affixed to the control panel of each machine. Then the machine was surveyed for compliance with the guides previously agreed upon and the data collected on the appropriate forms. An evaluation was then made of the physical plant itself, including an examination of the traffic patterns within the X-ray Department, the shielding incorporated in the walls of the examination room, and the proximity of the x-ray tube to adjacent occupied areas. A check was made of the darkroom facility to ensure that it was lighttight, that a thermometer was present, that a proper safe light was in use, and that the time-temperature method of film development was being followed.

As part of the survey, the operator of the equipment was questioned about the procedures and techniques he employed in the conduct of his duties and also about the training he had received since assuming his duties.

Upon completion of the survey, the medical officer-in-charge or his designated representative was advised verbally by the surveyor of the deficiencies noted during the survey. A comprehensive written report covering the survey was later submitted to the facility, with a copy also going to the project officer for the Bureau of Prisons.

SURVEY FINDINGS

Following the completion of the survey program, the data were analyzed by the Center and the findings summarized.

FACILITY INFORMATION

Table 2 summarizes the personnel, equipment, and machine workloads of the x-ray facilities surveyed.

Each facility surveyed consisted of one medical x-ray machine and one dental x-ray machine with the exception of the Medical Center for Federal Prisoners at Springfield, Missouri. This facility, a 600-bed hospital for prisoners with mental and emotional disorders and chronic diseases, has an x-ray department equipped for most diagnostic and therapeutic procedures.

As of October 1, 1968, there were 20,030 prisoners incarcerated in the 24 facilities surveyed. When one compares this number with the 130,208 x-rays taken per year, it appears that each inmate receives approximately 6.4 x-rays per year. In reality, the total number of x-rays taken reflects the turnover rate among inmates, annual physicals given to Justice Department employees, chest x-rays to new inmates, and preemployment chest x-rays for all personnel. The low fluoroscopic workload was due to the fact that most of this work was contracted out to local radiologists. As can be seen in table 2, the facility workloads (medical and dental) were relatively low. Although not shown in the table, the shielding (structural and added) of all facilities surveyed was found to be adequate for the workloads involved.

DEFICIENCIES IN RADIOGRAPHIC MACHINES

Table 3 presents the deficiencies noted on the diagnostic radiographic units surveyed.

On 34.2 percent of the medical x-ray machines surveyed and 4.0 percent of the dental x-ray machines, the total filtration in the useful beam was found to be less than that required on the basis of the maximum tube potential. In each instance where this deficiency was noted, sufficient additional aluminum filtration was added to bring the total up to the value required by the maximum tube potential.

Inadequate collimation of the useful beam, in that the dimensions of the primary beam exdeeded the dimensions of the film size used, was found on 32.4 percent of the medical x-ray machines surveyed. This was particularly true in the case of those machines used almost exclusively for chest radiography.

Table 2. Facility information.[a]

Personnel	Number	Average/facility
Number of personnel occupationally exposed	155	6.4
Number of personnel monitored	193	8.0
Number of x-ray machine operators	114	4.7
Number of operators per machine	1.9	
Equipment		
Total number of x-ray machines	60	2.5
Number of dental x-ray machines	25	1.0
Number of medical x-ray machines	35	1.0
Fixed Radiographic	4	
Radiographic-fluoroscopic	21	
Mobile	8	
Photofluoroscopic	1	
Therapy	1	
Workload		
Number of patients radiographed/yr		
Medical	45,240	1,885
Dental	30,160	1,256
Number of exposures (films)/yr		
Medical	78,125	3,255
Dental	52,083	2,169
Number of patients fluoroscoped/yr	2,496	104
Number of therapy treatments/yr	50	--[b]
Radiographic workload mA-min/yr		
Medical	30,992	1,291.3
Dental	4,680	19.5

[a]Based on 24 facilities. Does not include Morgantown, West Virginia.
[b]Only 1 therapy facility in operation.

Table 3. Deficiencies noted for diagnostic radiographic machines (medical and dental).

Deficiency	Number	Percent of machines surveyed
Total filtration required correction to meet appropriate standards		
Medical	12	34.2
Dental	1	4.0
Improper cone used, proper cone available		
Medical	4	11.8
Improper cone used, proper cone not available, variable collimator recommended		
Medical	7	20.6
Variable collimator present, operator not familiar with its use		
Medical	3	8.9
Beam diameter at cone tip exceeded 3 inches		
Dental	1	4.0
Timer inaccurate and/or nonreproducible		
Medical	1	2.8
Dental	17	68.0
Unsatisfactory operator protection		
Medical	10	16.6

Although 4 percent of the medical x-ray machines surveyed were equipped with a variable collimator which gave a visible indication of beam size, many of the operators of the machines did not know how to use the collimator correctly; therefore, its value in reducing unnecessary radiation exposure was negated.

Operator and patient protection was found to be adquate at most fixed machine installations. In general, a lead-lined shield or booth was provided for the operator, and there was sufficient shielding to protect persons outside of the x-ray room from scattered radiation. However, on 75 percent of the mobile x-ray machines the exposure switch cord length was such that it was not possible for the operator to stand at least six feet from the patient, the x-ray tube, and the useful beam. In each instance where the operator protection was found to be inadequate, recommendations have been made which will correct the condition when implemented.

DEFICIENCIES ON FLUOROSCOPES

Table 4 lists the deficiencies noted on the fluoroscopes surveyed.

Table 4. Deficiencies noted on fluoroscopic units.

Deficiency	Number	Percent of machines surveyed [a]
Lead protective gloves and aprons not available or not used	1	5.8
Protective cover for Bucky-slot absent	7	41.2
Diaphragm system permits x-ray beam to exceed area of viewing screen	10	58.8
Manually reset cumulative timer to indicate elapsed time absent	1	5.8
Protective drape between patient and fluoroscopist to intercept scattered radiation absent	13	76.5

[a]Based on 17 facilities with fluoroscopes in operation condition.

The major deficiencies observed were the absence of Bucky-slot covers, failure of the diaphragm system to restrict the x-ray beam to the area of the viewing screen, and the absence of a protective drape between the patient and fluoroscopist to intercept scattered radiation. The high

incidence of these three deficiencies may be used as an index of the age of the x-ray machines surveyed inasmuch as they are likely to be found on fluoroscopes manufactured prior to 1960. On machines manufactured after that date these appurtenances appear as standard equipment. The fact that the four fluoroscopes with no deficiencies had all been purchased within the last four years tends to support this thesis.

In none of the machines surveyed was the total filtration in the primary beam less than 2.5 mm aluminum equivalent. The dose rate at the panel top of all fluoroscopes surveyed was found to be equal to or less than 3.2R/mA-min. There were no instances of excessive transmission of the x-ray beam through the viewing screen. As in the case of those radiographic machines on which deficiencies were noted, recommendations for the correction of deficiencies have been made.

DENTAL X-RAY MACHINE TIMER

Dental x-ray machine timer accuracy and/or reproducibility proved to be deficient in a suprisingly large number of cases. To be considered accurate, the timer should deliver exactly the exposure time to which it has been set. Reproducibility is the ability to give the same exposure time in successive tests in which the timer setting remains the same. Of the two, reproducibility is the most important from the standpoint of reducing unnecessary radiation exposure. By adjusting the timer setting, the operator can compensate for a timer that is known or suspected to be inaccurate provided the exposure time is consistent in succeeding exposures. A timer that has poor reproducibility makes it almost impossible for the operator to compensate for this defect because of the variation in exposure time. Thus, the patient may receive unnecessary exposure from retakes necessitated by the unacceptable films produced as a result of the faulty timer.

The spinning top test which provides a visual comparison between x-ray pulse production and timer setting was used to measure timer system accuracy and reproducibility. The test was performed on all dental x-ray machine timers. In the conduct of the test the timer settings checked were those reported by the dentist or his assistant as being used for upper molars. Four successive tests were conducted at each setting using accuracy specifications described in Federal Specifications X-ray Apparatus, GG-X-620, December 7, 1954, paragraph 3.4.2.1-timers: "The timer shall be accurate to plus or minus 5 percent at any setting over 1 second, and plus or minus 10 percent at any setting under 1 second." Most dental x-ray exposure times are under 1 second; therefore, to be considered acceptable accuracy, the number of x-ray pulses observed on the developed film had to be within plus or minus 10 percent of the number of pulses equivalent to the timer setting.

Table 5 depicts the accuracy and reproducibility of the timing system on those dental x-ray machines surveyed.

Table 5. Accuracy and reproducibility of dental x-ray machine timing systems at selected settings.

Findings		Manufacturers			
Accuracy	Reproducibility	Weber	Ritter	XRMC	TOTAL
Acceptable	Acceptable	2	6	0	8
Acceptable	Unacceptable	0	0	0	0
Unacceptable	Acceptable	1	0	1	2
Unacceptable	Unacceptable	12	3	0	15
	TOTAL	15	9	1	25

From these results, it can be seen that 15 of the 25 timing systems tested (60 percent) failed to meet the standards set for both accuracy and reproducibility. Two timers (8 percent) were inaccurate but had good reproducibility, and only 8 timers (32 percent) met the standard for both accuracy and reproducibility.

Although the number of machines and manufacturers covered during the survey may not constitute a representative sample, the data did indicate that timer accuracy and reproducibility were problems in machines produced by certain manufacturers. This appears to be especially true in the case of Weber x-ray machines. Of the 15 Weber x-ray machines surveyed, 12 had timing systems that were unacceptable for both accuracy and reproducibility. The timing system on the two Weber x-ray machines that were acceptable for both accuracy and reproducibility were systems that had been put on the machines as replacements for the factory-installed timing system which had been found to be defective.

OPERATOR QUALIFICATIONS

The most notable deficiency observed during the surveys was that of operator training. At each of the facilities surveyed the principle operator of the medical and dental x-ray equipment was an inmate technician who, as might be expected, had had no prior training in radiologic technology. Although the medical-technical assistants assigned to each facility have had some formal training and experience in radiologic technology, the duties assigned to these individuals make it almost impossible for them to devote much of their time to the training of inmate technicians. Because of the manner in which the on-the-job training of technicians was conducted, poor techniques tended to be passed from technician to technician. This fact was especially evident at those facilities with x-ray machines equipped with variable collimators. In general, the operators of these x-ray machines did not know how to properly use the collimator; therefore, its value as a mechanism for reducing unnecessary radiation exposure was correspondingly reduced.

RECOMMENDATIONS AND ACCOMPLISHMENTS

An analysis of the data collected revealed that inadequate x-ray machine operator training and the modification of existing equipment so that it meets currently acceptable standards are the major problem areas. In view of these facts, the following recommendations were made:

1. Initiate a short radiologic technologist training program for selected inmates at the Medical Center for Federal Prisoners, Springfield, Missouri. The graduates of this program can be transferred to the other custodial institutions where they would serve as radiologic technologists for the balance of their sentences. Repetition of this course will provide the Bureau with a steady supply of trained x-ray machine operators.

2. Implement the modifications or changes in equipment and operating procedures recommended by the surveyors.

3. Advise the Weber Dental Manufacturing Company of the deficiencies observed in their dental x-ray machine timers.

   a. Request any proposals the Weber Company has on inaccurate timers on equipment already in service.

   b. Request any company plans to improve the quality of their timers through improved quality control or equipment redesign.

4. Continue the facility radiation safety survey program with the following frequency:

a. Every year - The United States Penitentiaries at Atlanta, Georgie; Leavenworth, Kansas; Lewisburg, Pennsylvania; and the Medical Center for Federal Prisoners at Springfield, Missouri.

b. Every two years - Federal Correctional Institutions at Danbury, Connecticut; Milan, Michigan; Sandstone, Minnesota; Lompoc, California; Terminal Island, California; La Tuna, Texas; Seagoville, Texas; Texarkansas, Texas; Tallahassee, Florida; Morgantown, West Virginia. Federal Reformatories at Alderson, West Virginia; Petersburg, Virginia; El Reno, Oklahoma; Federal Youth Centers at Ashland, Kentucky; and Englewood, Colorado. Federal Prison Camps at Safford, Arizona; Maxwell AFB, Alabama; Eglin AFB, Florida. United States Penitentiaries at McNeil Island, Washington; Terre Haute, Indiana; Marion, Illinois; and the Federal Detention Headquarters, New York City.

The following actions have been taken in implementation of the above recommendations:

1. A one-week radiation safety course for Medical Technical Assistants was presented at the Medical Center, Springfield, Missouri, during March 1970.

2. Modifications to equipment have been made as recommended.

3. Weber Dental Manufacturing Company has been notified of the deficiencies; attempts at corrective action are still in progress.

4. The facility survey agreement was renegotiated; the surveys will be accomplished at the recommended frequency.

APPENDIX A

MEMORANDUM OF AGREEMENT

Between

Division of Health Services
Bureau of Prisons

and

Department of Health, Education, and Welfard
Public Health Service
National Center for Radiological Health

for

Facility Radiation Safety Surveys

I. PURPOSE

To develop, through Interagency cooperation, an organized, coordinated radiological health survey program within the Division of Health Services, Bureau of Prisons directed towards reducing unnecessary exposure to ionizing radiation.

II. CONTRACTOR'S NAME:

National Center for Radiological Health
Medical and Occupational Radiation Program
X-ray Section

III. SPONSOR'S NAME:

Bureau of Prisons
Division of Health Services

IV. DESCRIPTION OF WORK:

A. Objective

1) Initiate and conduct a survey of all X-ray installations within one year. Each survey will include a complete Radiological Health and Safety evaluation as it applies to the safety of patients, operating personnel and occupants of adjacent areas.

2) To recommend modifications or changes in equipment and operating procedures which when implemented will reduce patient and occupational exposures.

3) To implement and administer a Bureau-wide registration of radiation sources program.

4) To develop a system whereby all or selected facilities within the Bureau will be resurveyed every two years.

5) To promote interest in the principles of radiation protection among Bureau personnel responsible for the operation of X-ray equipment.

B. Procedure

1) All arrangements for conducting surveys inclusive of scheduling, travel and quarters will be handled by the contractor.

2) The contractor agrees to supply the sponsor 133 film badges during the period covered by this agreement and survey all Division of Health Services, Bureau of Prisons x-ray facilities operating as of the date of this agreement is signed. They will contact each institution.

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3) The contractor will provide the sponsor with a tentative timetable of facility visitations within thirty (30) days after the signing of this agreement so that the necessary clearances can be made.

4) The sponsor will provide the contractor with letters of clearance, or their equivalent, for project personnel to be named by the contractor.

5) The sponsor will provide, at each facility, one (1) person who will operate the x-ray equipment and be available to assist the surveyor.

V. STANDARDS OR GUIDES:

The standards as set forth in NBS Handbook 76 "Medical X-ray Protection Up to Three Million Volts" or an adopted revision thereof shall be the guide for the survey and compliance purposes of x-ray equipment.

VI. COST TO THE GOVERNMENT:

Each institution will reimburse the USPHS, National Center for Radiological Health for perdiem and travel. Transfer of funds will be made by utilizing Form 1080 and each institution will be billed individually. The contract sets a maximum expenditure of $4000.00 including $500.00 for film badge service for the entire Bureau.

VII. PERIOD OF SERVICE:

The initiation date of this contract will be January 1, 1968, and closing date December 31, 1968.

VIII. PROJECT DIRECTOR:

LaVert C. Seabron, Radiation Specialist
X-ray Section
Medical and Occupational Radiation Program
National Center for Radiological Health

IX. PROJECT OFFICER:

Stanley Raynor, DDS
Radiation Safety Program
Division of Health Services
Bureau of Prisons

X. REPORTS:

Upon completion of the radiological health survey of each facility, the contractor shall prepare a written "Radiological Health Survey Report", which will contain the findings and recommendations of the contractor.

The distribution of the Radiological Health Survey Report shall be as follows:

1) Two copies -- Bureau of Health Services Project Officer
2) One copy -- Medical Officer in charge of facility
3) One copy -- NCRH Regional Representative of the Region in which the facility is located
4) One copy National Center for Radiological Health files

APPROVED:

Robert R. Harwick
Executive Officer
National Center for Radiological Health

Edward Zieses
Contracting Officer
Bureau of Prisons

Ernest C. Siegfried, M.D.
Asst Surgeon General, US PHS
Medical Dir, Bur of Prisons

APPENDIX B

POLICY STATEMENT

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BUREAU OF PRISONS WASHINGTON, D. C. 20537

P O L I C Y S T A T E M E N T

27260.1

SUBJECT: Survey of X-ray Installations

12-13-67

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1. PURPOSE. To establish standards for maintenance of hospital x-ray machines and utilization of radiation badges to protect the health of staff and inmate patients.

2. EXPLANATION. The Bureau of Prisons has entered into a contract with the National Center for Radiological Health to survey all x-ray installations within the Bureau. Each survey will include a complete radiological health and safety evaluation as it applies to the safety of the patients, operating personnel and occupants of adjacent areas.

3. ACTION.

a. The Division of Radiological Health will contact each installation and make arrangements for the survey.

b. Each institution will reimburse the USPHS, Division of Radiological Health for per diem and travel. Transfer of funds will be made utilizing Form 1080 and each institution will be billed individually.

c. This will be part of continuing maintenance program similar to boiler and elevator inspections.

d. The contract sets a maximum expenditure of $4,000 including $500 for film badge service for the entire Bureau. Therefore, the cost to each institution for this excellent service will be minimal. A copy of the contract will be furnished to each institution.

DAVID C. JELINEK
Assistant Director
Administrative Services

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APPENDIX C

FACILITY SURVEY FORM

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DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

X-RAY PROTECTION SURVEY REPORT
FACILITY

FORM APPROVED
BUDGET BUREAU NO. 68-R508

1. NAME OF FACILITY

2. TELEPHONE

3. NUMBER ASSIGNED BY AGENCY (1 2 3 4 5 6)

4. LOCATION *(Street, Building, Room Number)*

7. STATE (18 19) COUNTY (20 21 22) CITY (23 24 25 26) ZIP CODE

5. DATE *(Mo., Day, Yr.)* (7 8 9 10 11 12)

6. CARD I.D. 1 (13 14 15 16 17)

8. PERSON IN CHARGE OF X-RAY FACILITY

9. PERSON RESPONSIBLE FOR RADIATION SAFETY: NAME TITLE

10. PERSON INTERVIEWED: POSITION

11. PREVIOUS RADIATION SAFETY SURVEY: 1.___Yes 2.___No (27)
BY WHOM: DATE:

12. TYPE OF FACILITY: 1.___ Private Office 2.___ Hospital 3.___Clinic (28)
4.___ Mobile 5.___ Other *(Specify)*

13. TYPE OF PRACTICE: (29 30)

14. PERSONNEL

A. TOTAL NUMBER OCCUPATIONALLY EXPOSED _____ (A 31 32)

B. TOTAL NUMBER OF OPERATORS _____ (33 34) C. TOTAL NUMBER MONITORED _____ (C 35 36)

D. MONITORING SYSTEM EMPLOYED: 0.___ Never or none 1.___Currently
2.___Within past year 3.___ Not within past year (D 37)

E. MONITORING SYSTEM ADEQUATE: 1.___Yes 2.___No 3.___N/A (E 38)

F. MONITORING RECORDS SATISFACTORY: 1.___Yes 2.___No 3.___N/A (F 39)

G. LEVELS/MONTH: _____ Maximum MR. H. NUMBER OVER 300 MR/QUARTER _____ (H 40)

15. "WORKLOAD"

A. PATIENTS RADIOGRAPHED *(Average per week)* _____ (A 41 42 43 44)

B. PATIENTS FLUOROSCOPED *(Average per week)* _____ (B 45 46 47)

C. THERAPY TREATMENTS *(Average per week)* _____ (C 48 49 50)

16. EQUIPMENT

A. TOTAL NUMBER OF MACHINES AT THIS FACILITY _____ (A 51 52)

B. TOTAL NUMBER OF UNITS *(Tubes)* _____ (B 53 54)

17. FILM AND SCREEN

A. BRAND AND TYPE OF X-RAY FILM USED _____ (A 55 56)

B. TYPE OF INTENSIFYING SCREEN _____ (B 57 58)

18. DARKROOM PROCEDURE

A. DARKROOM LIGHT TIGHT: 0.___No darkroom 1.___Yes 2.___No (A 59)

B. TYPE OF DEVELOPER: _____ (B 60 61)

C. AUTOMATIC PROCESS: 1.___Yes 2.___No (C 62)

D. HOW OFTEN CHANGED *(Weeks)* _____ (63 64) E. HOW OFTEN REPLENISHED *(Days)* _____ (E 65 66)

F. THERMOMETER PRESENT: 1.___Yes 2.___No 3.___Thermostatically controlled (F 67)

G. TEMPERATURE INDICATED: _____°F (68 69) H. TIMER PRESENT: 1.___Yes 2.___No (70)

I. TIME IN DEVELOPER *(Minutes)* _____ (I 71 72)

19. RADIOACTIVE MATERIALS

A. RADIUM EVER PRESENT: 1.___ Yes 2.___ No (A 73)

B. OTHER ISOTOPES EVER PRESENT: 1.___ Yes 2.___ No (B 74)

20. REASON FOR SURVEY

1._____ Initial 2._____ Follow-up 3._____ Re-survey
4._____ Request 5 _____ Complaint 6._____ Other *(Specify)* (75)

21. SURVEYORS

A. _____ B. _____

PHS-4495-1 (REV. 10-67) *(Use reverse side for remarks or sketch)*

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WORKLOAD *(Ma-Min/wk)* _____ SHIELDING INFORMATION MAX. KVP _____

LOCATION	COMPOSITION AND THICKNESS	ENVIRONS OR CONTROL	PRIMARY OR SECONDARY	USE X OCCUPANCY	TARGET TO WALL DISTANCE	N.B.S. REQUIRED BARRIER	ADDITIONAL SHIELDING REQUIRED
NORTH *(Top)*							
EAST *(Right)*							
SOUTH *(Bot.)*							
WEST *(Left)*							
ABOVE							
BELOW							

SKETCH OF FACILITY AND/OR REMARKS

(Indicate scale used)

APPENDIX D

RADIOGRAPHIC SURVEY FORM

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

X-RAY PROTECTION SURVEY REPORT
RADIOGRAPHIC

FORM APPROVED
BUDGET BUREAU NO. 68-R005

1. NAME OF FACILITY

2. TELEPHONE

3. NUMBER ASSIGNED BY AGENCY (1 2 3 4 5 6)

4. LOCATION (Street, Building, Room Number)

7. STATE (18 19) COUNTY (20 21 22) CITY (23 24 25 26)

5. DATE (Mo., Day, Yr.) (7 8 9 10 11 12)

6. CARD I.D. 2 (13 14 15 16 17)

6. EQUIPMENT IDENTIFICATION

A. NUMBER ASSIGNED MACHINE _____

B. CONTROL PANEL MANUFACTURER _____ B (27 28)

C. TUBE HEAD MANUFACTURER AND MODEL _____ C (29 30)

D. COMBINATION: 1.___Yes 2.___No D (31)

E. TYPE: 1.___Fixed Radiographic (indicate special type) _____
2.___Photofluorographic 3.___Mobile 4.___Other (specify) _____ E (32)

F. NUMBER OF TUBES (33)

G. MAXIMUM KVP (RATED) (34 35 36)

H. MAXIMUM MA (RATED) (37 38 39)

9. FILTRATION

A. TOTAL MM. ALUMINUM EQUIVALENT A. BEFORE (40 41) B. AFTER (42 43)

10. "WORKLOAD"

A. AVERAGE NUMBER OF PATIENTS PER WEEK (estimate) _____ A (44 45 46)

B. TOTAL NUMBER OF EXPOSURES PER WEEK (estimate) _____

11. USUAL PROCEDURES

	EXAMINATION (specify)	KVP	MA / TIME	MAS	EXPOSURES PER WK.	FILM SIZE	DISTANCE (inches)	BEAM TYPE	BEAM SIZE (inches)	COLLIMATION
1.	(47)	(48 49 50)	/	(51 52 53)		(54)	(55 56)	(57)	(58 59)	(60)
2.	(61)	(62 63 64)	/	(65 66 67)		(68)	(69 70)	(71)	(72 73)	(74)
3.			/							

12. EXPOSURE SWITCH

A. ADEQUATE LOCATION: 1.___Yes 2.___No A (75)

13. TIMER

A. ADEQUATE: 1.___Yes 2.___No A (76)

14. PROTECTIVE DEVICES

A. GONADAL SHIELD FOR PATIENT: 1.___Yes 2.___No 3.___N/A A (77)

B. ADEQUATE OPERATOR PROTECTION: 1.___Yes 2.___No B (78)

C. ADEQUATE PRIMARY AND SECONDARY BARRIERS: 1.___Yes 2.___No 3.___N/A C (79)

D. DIAGNOSTIC-TYPE TUBE HOUSING: 1.___Yes 2.___No D (80)

15. STRAY RADIATION MEASUREMENTS

POSITION	EXPOSURE RATE MR/HR	POSITION	EXPOSURE RATE MR/HR
A. OPERATOR		D.	
B.		E.	
C.		F.	

(MAXIMUM READINGS TAKEN AT KVP_____ MA _____ SECONDS _____)

16. SURVEYORS

A. _____ B. _____

PHS-449S-3 (REV 7-65)

(Use reverse side for remarks or sketch)

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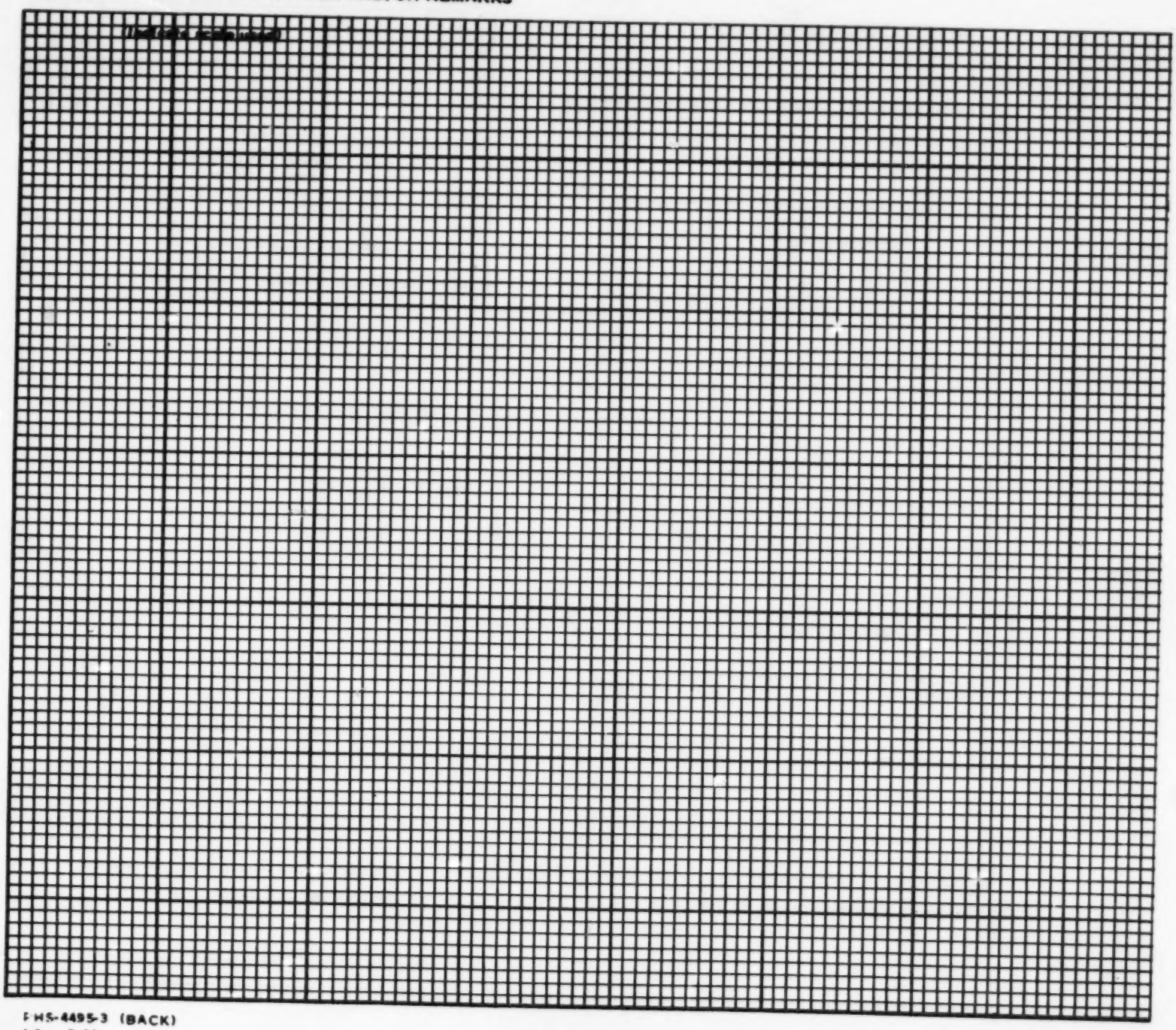
WORKLOAD (20ma-60sec/wk) _____ SHIELDING INFORMATION MAX. KVP _____

LOCATION	COMPOSITION AND THICKNESS	ENVIRONS OR CONTROL	PRIMARY OR SECONDARY	USE X OCCUPANCY	TARGET TO WALL DISTANCE	N.B.S. REQUIRED BARRIER	ADDITIONAL SHIELDING REQUIRED
NORTH (Top)							
EAST (Right)							
SOUTH (Bot.)							
WEST (Left)							
ABOVE							
BELOW							

SKETCH OF RADIOGRAPHIC ROOM AND/OR REMARKS



APPENDIX E

FLUOROSCOPIC SURVEY FORM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

X-RAY PROTECTION SURVEY REPORT
FLUOROSCOPIC

FORM APPROVED
BUDGET BUREAU NO. 68-R808

1. NAME OF FACILITY | 2. TELEPHONE | 3. NUMBER ASSIGNED BY AGENCY (1 2 3 4 5 6)

4. LOCATION (Street, Building, Room Number) | 7. STATE | COUNTY | CITY | ZIP CODE

5. DATE (Mo., Day, Yr.) (7 8 9 10 11 12) | 6. CARD I.D. 3 (13 14 15 16 17) | (18 19) | (20 21 22) | (23 24 25 26)

8. EQUIPMENT IDENTIFICATION

A. NUMBER ASSIGNED MACHINE _____ B (27 28)

B. CONTROL PANEL MANUFACTURER _____ C (29 30)

C. TUBE HEAD MANUFACTURER AND MODEL _____ D (31)

D. COMBINATION: 1. ___ Yes 2. ___ No

E. TYPE: 1. ___ Vertical 2. ___ Horizontal 3. ___ Tilting Table 4. ___ Other E (32)

F. IMAGE INTENSIFYING DEVICE USED: 1. ___ Yes 2. ___ No F (33)

G. OTHER IDENTIFICATION (Specify)

9. ACCESSORY SHIELDING

A. LEADED GLOVES: 1. ___ Yes 2. ___ No (34) B. LEADED APRON: 1. ___ Yes 2. ___ No B (35)

C. BUCKY SLOT COVER: 1. ___ Yes 2. ___ No 3. ___ N/A C (36)

D. LEADED DRAPES AROUND SCREEN: 1. ___ Yes 2. ___ No 3. ___ N/A D (37)

E. OTHER (Specify)

10. DARK ADAPTATION

A. GOGGLES USED: 1. ___ Yes 2. ___ No B. NUMBER OF MINUTES: _____ B (38 39)

11. USUAL PROCEDURES

EXAMINATION	KVP	MA	MINUTES TUBE ACTIVATED PER EXAMINATION	EXAMINATIONS PER WEEK
A. UPPER G. I.	(40 41 42)	(43 44)	(45)	(46 47)
B. LOWER G.I.	(48 49 50)	(51 52)	(53)	(54 55)
C. OTHER (Specify)				(56 57)
D. TOTAL MA-MIN/ WEEK				(58 59 60)

12. SPOT FILMS

A. AVERAGE EXPOSURES PER WEEK: _____ (61 62 63)

13. SCREEN

A. FLUOROSCOPIC SCREEN GANGED TO X-RAY TUBE: 1. ___ Yes 2. ___ No A (64)

B. LEADED GLASS SATISFACTORY: 1. ___ Yes 2. ___ No 3. ___ N/A B (65)

C. SHUTTERS FUNCTION PROPERLY: 1. ___ Yes 2. ___ No 3. ___ Fixed C (66)

D. USEFUL BEAM LIMITED TO SCREEN: 1. ___ Yes 2. ___ No D (67)
Overlap: ___ Top ___ Right ___ Bottom ___ Left

14. DISTANCE

A. TARGET TO PANEL (Inches): _____ A (68 69)

15. ROENTGEN OUTPUT

A. USEFUL BEAM AT PANEL SURFACE: _____ R/MIN. A (70 71 72)

16. FILTRATION

A. TOTAL MM. ALUMINUM EQUIVALENT: A. Before (73 74) B. After (75 76)

17. TIMER

A. DEADMAN TYPE EXPOSURE SWITCH: 1. ___ Yes 2. ___ No

B. MANUALLY RESET CUMULATIVE TIMER: 1. ___ Yes 2. ___ No

C. CUMULATIVE TIMER TERMINATES EXPOSURE: 1. ___ Yes 2. ___ No

A (77) B (74) C (78)

18. FLUCROSCOPIC ROOM

A. LIGHT TIGHT: 1. ___ Yes 2. ___ No 3. ___ N/A A (80)

19. STRAY RADIATION MEASUREMENTS

POSITION	EXPOSURE RATE (MR/HR)	POSITION	EXPOSURE RATE (MR/HR)
A. OPERATOR		D.	
B. ABOVE SCREEN		E.	
C.		F.	

(MAXIMUM READINGS TAKEN AT KVP_____ MA _____ SECONDS _____)

20. SURVEYORS

A. _____ B. _____

PHS-4495-2 (REV. 10-67)

(Use reverse side for remarks or sketch)

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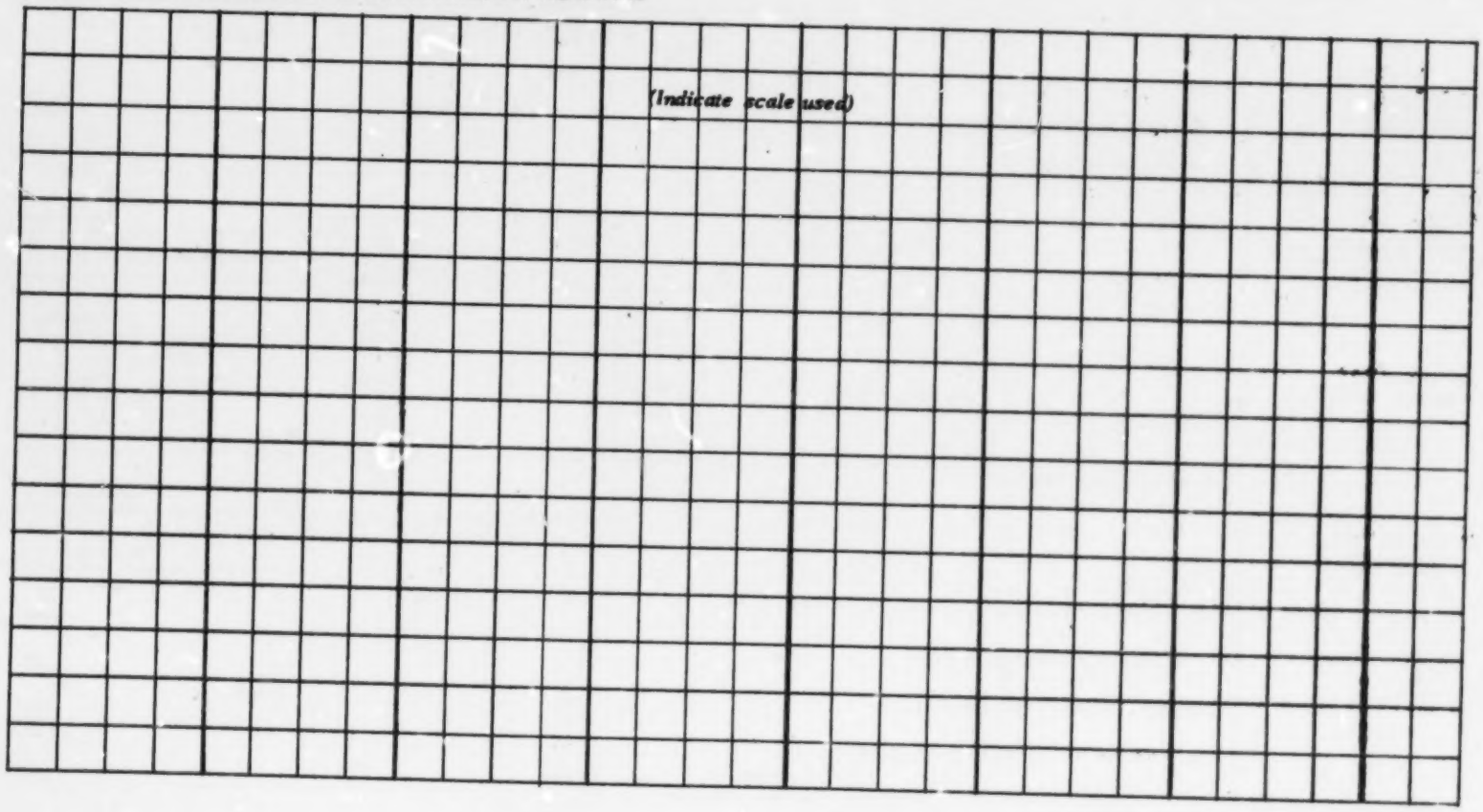
WORKLOAD *(Ma-Min/wk.)* _____ **SHIELDING INFORMATION** MAX. KVP _____

LOCATION	COMPOSITION AND THICKNESS	ENVIRONS OR CONTROL	PRIMARY OR SECONDARY	USE X OCCUPANCY	TARGET TO WALL DISTANCE	N.B.S. REQUIRED BARRIER	ADDITIONAL SHIELDING REQUIRED
NORTH *(Top)*							
EAST *(Right)*							
SOUTH *(Bot.)*							
WEST *(Left)*							
ABOVE							
BELOW							

SKETCH OF FLUOROSCOPIC ROOM AND/OR REMARKS



APPENDIX F

THERAPEUTIC SURVEY FORM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

RADIATION PROTECTION SURVEY REPORT
THERAPEUTIC

FORM APPROVED
BUDGET BUREAU NO. 68-R908

1. NAME OF FACILITY | 2. TELEPHONE | 3. NUMBER ASSIGNED BY AGENCY (1 2 3 4 5 6)

4. LOCATION (Street, Building, Room Number) | 7. STATE | COUNTY | CITY | ZIP CODE

5. DATE (Mo., Day, Yr.) (7 8 9 10 11 12) | 6. CARD I.D. 4 (13 14 15 16 17) | (18 19) | (20 21 22) | (23 24 25 26)

5. EQUIPMENT IDENTIFICATION

A. NUMBER ASSIGNED UNIT _____ B. RADIATION SOURCE _____ (27) C. UNIT MANUFACTURER: _____ (28 29)

D. TYPE OF UNIT: 1. ☐ Superficial 2. ☐ Deep 3. ☐ Supervoltage 4. ☐ Teletherapy 5. ☐ Other (Specify) _____ (30)

9. "WORKLOAD"

X-RAY

A. AVERAGE TIME PER TREATMENT (MIN.) _____ (31 32)

B. AVERAGE NUMBER OF TREATMENTS PER WEEK _____ (33 34 35)

C. MAXIMUM kVp USED _____ (36 37 38 39)

D. MAXIMUM mA USED _____ (40 41)

E. AVERAGE mAm PER WEEK _____ (42 43 44 45)

ISOTOPE

F. STRENGTH OF RADIONUCLIDE (RHM) _____ (46 47 48 49)

G. ROENTGENS PER WEEK AT ONE METER _____ (50 51 52 53)

10. FILTRATION

A. FILTER IDENTIFICATION SYSTEM 1. ☐ Yes 2. ☐ No 3. ☐ N/A (A 54)

B. SECURE FILTER SLOT 1. ☐ Yes 2. ☐ No 3. ☐ N/A (B 55)

11. COLLIMATION

A. SHUTTER POSITION INDICATED AT CONTROL 1. ☐ Yes 2. ☐ No 3. ☐ N/A (A 56)

B. VARIOUS PORT SIZES AVAILABLE 1. ☐ Yes 2. ☐ No 3. ☐ N/A (B 57)

C. LEAD RUBBER, FOIL, ETC., TO LIMIT FIELD 1. ☐ Yes 2. ☐ No 3. ☐ N/A (C 58)

12. PROTECTIVE QUALITIES AND DESCRIPTIVE INFORMATION

A. TYPE OF TREATMENT 1. ☐ Stationary 2. ☐ Rotational (A 59)

B. ADEQUATE INTERLOCK SYSTEM 1. ☐ Yes 2. ☐ No 3. ☐ N/A (B 60)

C. MANUALLY RESET CUMULATIVE TIMER 1. ☐ Yes 2. ☐ No 3. ☐ N/A (C 61)

D. TIMER TERMINATES EXPOSURE 1. ☐ Yes 2. ☐ No 3. ☐ N/A (D 62)

E. PATIENT AND CONTROL OBSERVED SIMULTANEOUSLY 1. ☐ Yes 2. ☐ No 3. ☐ N/A (E 63)

F. PATIENT-OPERATOR COMMUNICATION AVAILABLE 1. ☐ Yes 2. ☐ No 3. ☐ N/A (F 64)

G. RADIATION AREA POSTED 1. ☐ Yes 2. ☐ No 3. ☐ N/A (G 65)

H. PRIMARY BEAM SHIELD PRESENT 1. ☐ Yes 2. ☐ No 3. ☐ N/A (H 66)

I. CONTROL PANEL LOCKED WHEN NOT IN USE 1. ☐ Yes 2. ☐ No 3. ☐ N/A (I 67)

J. SOURCE CALIBRATED ANNUALLY 1. ☐ Yes 2. ☐ No 3. ☐ N/A (J 68)

DATE OF LAST CALIBRATION _____

K. THERAPEUTIC TYPE PROTECTIVE SOURCE HOUSING 1. ☐ Yes 2. ☐ No 3. ☐ N/A (K 69)

L. PRIMARY AND SECONDARY BARRIERS ADEQUATE 1. ☐ Yes 2. ☐ No 3. ☐ N/A (L 70)

M. ADEQUATE OPERATOR PROTECTION 1. ☐ Yes 2. ☐ No 3. ☐ N/A (M 71)

N. BEAM MONITORING DEVICE 1. ☐ Yes 2. ☐ No 3. ☐ N/A (N 72)

O. EMERGENCY PROCEDURES POSTED 1. ☐ Yes 2. ☐ No 3. ☐ N/A (O 73)

P. LEAK TEST PERFORMED 1. ☐ Yes 2. ☐ No 3. ☐ N/A (P 74)

DATE OF LAST TEST _____

13. SURVEYORS

A. _____ B. _____

PHS-6495-7 (REV. 2-67) (Use reverse side for sketch and/or remarks)

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RADIATION MEASUREMENTS

____ ____ TAKEN AT _____ kV _____ FIELD SIZE _____ FILTER _____

LOCATION OF MEASUREMENTS	SKETCH POSITION	HEIGHT OF INSTRUMENT ABOVE FLOOR (IN FEET)	BEAM DIRECTION (IN DEGREES)	PHANTOM		mR/HOUR	REMARKS
				YES	NO		

15. SKETCH AND/OR REMARKS

16 SHIELDING INFORMATION

WORKLOAD (mAmin/wk) _____ MAX. kVp _____

LOCATION	COMPOSITION AND THICKNESS	ENVIRON OR CONTROL	PRIMARY OR SECONDARY	USE X OCCUPANCY	TARGET TO WALL DISTANCE	N.B.S. REQUIRED BARRIER	ADDITIONAL SHIELDING REQUIRED
NORTH (Top)							
EAST (Right)							
SOUTH (Bot.)							
WEST (Left)							
ABOVE							
BELOW							

PHS-4495-7 (BACK)
REV. 2-67

APPENDIX G

DENTAL SURVEY FORM

X-RAY PROTECTION SURVEY REPORT
DENTAL

1. Name of Facility | 2. Telephone No. | 3. Registration No.

4. Address (St., Bldg., Room No.) | 5. State | County | City

6. Date Mo., Day, Yr. | 7. Card I.D. | 8. Surveyor(s)

9. Type of Practice 1. General___ 2. Oral Surgery___ 3. Other ___

10. Equipment Identification
A. Manufacturer_____ B. Model _____
C. Console Serial No._____ D. Tube Serial No. _____
E. Maximum kVp (Rated _____ F. Maximum mA (Rated) _____

11. Pointer Cone 0. None _____ 2. Short Open _____ 4. Long Open _____ 6. Is pointer cone shielded? Yes ___ No ___
1. Short Pointed__ 3. Long Pointed _____ 5. Panoramic _____

12. Filtration (Total MM. Aluminum Equivalent)
Before _____After_____Filtration in compliance? Yes ___ No ___

13. Collimation (Field Diameter at End of Cone) (Inches)
Before _____ After _____ Collimation in Compliance? Yes ___ No ____

14. Workload A. Average Number of Patients Per Week _____ (estimate)
B. Total Number of Exposures Per Week _____ (estimate)

15. Usual Procedures (Describe) 1. Upper Molar 2. _____

	kVp	mA	Time	mAs

16. Estimated Occupational Exposure:
(Exposures/wk) (Calculated Ave. Exp. Time) (Ave. Exp.mr/hr) (0.015) = _____mr/yr

17. Exposure Mechanism:
A. Satisfactory Location Yes ___ No ___ If No, Specify _____
B. Timer Accurate Yes ___ No ___ (Refer to Item No. 21.)

18. Protective
A. Lead Apron for patients: Yes ____ No ____ Unk. ____
B. Satisfactory Operator Protection: Yes ____ No ____ Unk. ____
C. Satisfactory Primary Barriers: Yes ____ No ____ Unk. ____
D. Satisfactory Secondary Barriers: Yes ____ No ____ Unk. ____
E. Tube Housing Leakage: Yes ____ No ____ Unk. ____
F. Unit Grounded: Yes ____ No ____ Unk. ____
G. Use film holding devices: Yes ____ No ____ Unk. ____

19. Stray Radiation Measurements Reading at: kVp___mA___sec.___

Position	Exposure Rate in mr/hr	Position	Exposure Rate in mr/hr

20. Is the unit in compliance? Yes ____ No ____

21. Timer Accuracy:
A. Type of Timer _____ B. Range of Timer _____
C. Type of Rectification _____

TIMER SETTING	0.1 (1/10)sec.	0.25 (1/4)sec.	0.5 (1/2)sec.
Pulses:			

22. REMARKS: _____

ACCURACY: ± 5% at settings> 1.0 second
± 10% at settings< 1.0 second

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APPENDIX H

REGISTRATION OF RADIATION SOURCES FORM

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RADIATION SOURCE REGISTRATION FORM

1. Name of Facility _____

2. Location: _____

_____

3. Division: _____

4. Bureau: _____

5. Name & Title of Person to Contact For Further Information: _____

6. Type of Use or Practice: (Check appropriate blank)
   1. Medical _____
   2. Dental _____
   8. Research _____
   9. Other (Specify) _____

7. Type of Facility: (Check one)
   2. Hospital _____ 3. Clinic _____ 4. Mobile _____
   5. Educational Institution _____ 7. Other (Specify) _____

8. Type of Machine:
   A. 1. Single Radiographic _____
      2. Single Fluoroscopic _____
      3. R. & F. Combination _____
      4. Photofluorographic _____
      5. X-ray Therapy _____
      6. Dental X-ray _____

      Total Number of Tubes _____
   B. Manufacturer _____ Console Serial No. _____
      Model _____ Fixed _____ Portable _____
   C. Maximum: kVp _____ mA _____

9. Radioactive Materials: (If none at facility check here _____)
   A. Radium: 1. Yes _____ 2. No _____
      1. Number of Radium Sources _____
      2. Total Activity of Radium Sources _____(mg)
   B. No. of Teletherapy Apparatus' _____
   C. Licensed Isotopes? 1. Yes _____ 2. No _____
   D. Other Non-licensed Isotopes? 1. Yes _____ 2. No _____

10. To the best of my knowledge, the above information is correct.

Name (Type or Print) _____ Title _____

Signature: _____ Date _____

REGISTRATION OF THIS SOURCE DOES NOT IMPLY APPROVAL OF THE EQUIPMENT OR ITS OPERATION

Registration No. _____

* U. S. GOVERNMENT PRINTING OFFICE : 1970—436-612/16

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LaVert C. Seabron
RADIATION SAFETY SURVEYS OF X-RAY FACILITIES WITHIN THE BUREAU OF PRISONS DURING 1968

Accession No.

U.S. Department of Health, Education, and Welfare, Public Health Service Publication Number BRH/DEP 70-19 (July 1970) 45 pp. (limited distribution).

ABSTRACT: This report describes the first comprehensive survey of the x-ray facilities in the Bureau of Prisons installations throughout the United States. The data summarized cover visits to 27 facilities, a total of 60 x-ray machines. The report discusses the workloads at the facilities, the type of equipment, the deficiencies noted in diagnostic radiographic x-ray

(over)

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(over)

machines (medical and dental), and operator training. Also included are recommendations for improving both operator and patient protection.

KEYWORDS: X-ray survey, Bureau of Prisons, Radiation safety, X-ray equipment safety.

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KEYWORDS: X-ray survey, Bureau of Prisons, Radiation safety, X-ray equipment safety

DIVISION OF ELECTRONIC PRODUCTS

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(continued from inside of front cover)

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BRH/DEP 70-8	Development of Liquid Crystal Microwave Power Density Meter (May 1970)	PB 191 396
BRH/DEP 70-9	Product Testing and Evaluation of Giant View® TV Projector (May 1970)	PB 191 906
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BRH/DEP 70-16	Near Field Instrumentation (July 1970)	
BRH/DEP 70-17	Radiation Safety Surveys of X-ray Facilities within the Federal Health Programs Service (July 1970)	
BRH/DEP 70-18	Bremsstrahlung Production (July 1970)	
BRH/DEP 70-19	Radiation Safety Surveys of X-ray Facilities within the Bureau of Prisons During 1968 (July 1970)	

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HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of Radiological Health
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